

## Technology Transfer: What India can learn from the United States

Kelly G Hyndman, Steven M Gruskin and Chid S Iyer†

Sughrue Mion PLLC, 2100 Pennsylvania Ave, NW, Washington DC 20037, USA

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Indian universities and government-funded research organizations produce world-class research that is mostly published in scientific journals. While the society gains from the increased knowledge, the university or the government receives very little direct benefit. Developed countries like the United States have been encouraging similar institutions to secure their intellectual property rights in the new technology arising out of the research in addition to merely publishing in scientific journals. The United States has a long history of supporting technical research and has gradually evolved to this model. India should learn from the experience of the United States in this regard. Premier institutions of learning and research in the United States provide effective models that use patents and their licensing as tools for technology transfer. This paper discusses a brief history of tech transfer in the United States, followed by a discussion of the Bayh-Dole Act, which served as a catalyst for the successful tech transfer regime in effect today. Various aspects of IP ownership are discussed, followed by a relevant case study.

**Keywords:** Technology transfer, Bayh-Dole Act, IP ownership

India has a vast network of publicly owned research and development facilities. The numerous laboratories under the CSIR umbrella, the IITs, the IISc, TIFR, BARC, etc, produce world class research in various technology areas of importance to mankind. Like their counterparts in the rest of the world, publishing peer-reviewed scientific papers and/or generating technical reports for internal use have been the primary means of disseminating this information or ‘transferring technology.’ While adding to scientific glory and prestige, these institutions and the Indian government have gained little in terms of direct economic benefits.

In most developed economies and in fast developing economies, advanced research, development and technical expertise coming out of universities and research organizations needs to be transferred for the public good. It is amply clear that such institutions, in addition to providing for the public good, support local governments in business development. On the other hand, in today’s knowledge-based economy, universities and research organizations require both capital and knowledge. To continue the support provided by the government as well as to return some of the direct benefits to the public, initiatives and incentives are required for these institutions to fully capitalize on the technology they produce.

India can learn from the United State’s history of technology transfer and the initiatives provided by the United States government, for example, the Bayh-Dole Act, that served as a catalyst for such technology transfer. A developing economy like India should benefit from the experiences of the United States in formulating a technology transfer policy.

### **A Brief History of Tech Transfer in the US**

For over a hundred years, the United States has been supporting public universities, which in turn have served as an impetus to research and development. In 1862, the United States passed the Morrill Act<sup>1</sup>. According to this Act, the United States government started allocating 30,000 acres of public land in each state to establish land grant colleges, thereby offering patronage to research and development performed by these universities. A key interest of the government was the consolidation of agricultural, economic, military and research interests as well as solidifying the economic infrastructure. The Morrill Act played a significant role in achieving this goal. In 1890, the Morrill Act was further strengthened with endowments and support provided to agricultural and mechanical arts. In addition, land grants were provided to additional states mainly in the south<sup>2</sup>. The Morrill Act thus provided a boost to research and served as a means of technology transfer

†Email: [ciyer@sughrue.com](mailto:ciyer@sughrue.com)

and economic development activities. Increasingly, the scientific community started viewing knowledge as a commodity in addition to using it to satisfy intellectual curiosity<sup>3</sup>. In addition, while resources provided by the government acted as a catalyst, universities also started attracting research funding from private entities such as corporations.

At the time of Morrill Act, the only means of effecting 'technology transfer' to the public was by way of publications. Researchers were required to perform research in an unbiased way and publish it for the common good. While researchers accepted grants as a 'necessary evil,' accepting royalties for the knowledge generated was considered taboo. A few important issues arose at this point. A broad issue was whether universities should allow commercial forces to determine their research and academic missions. Should the universities allow the sponsors of research to dictate the terms of research or influence the research. If private entities, such as, corporations are funding the research, should the universities follow a research agenda that is guided by these private entities.

What the purists feared most started happening, slowly but surely. Private entities, especially, corporations that once gave unrestricted money to colleges to cultivate good will, started backing projects based principally on their commercial worth. In addition, corporations started asking for first rights of refusal and at times exclusive rights to the intellectual property arising out of the research. To cope with this demand and to share in the benefits, universities began to file for and obtain patents, and began opening technology-licensing offices.

The University of Wisconsin was one of the first universities to begin this trend by establishing a plan in 1924 to license patents generated by its faculty. The intense financial pressure generated by great depression of the 1930s further sparked the interest of the universities in obtaining patents and generating revenues. The technological demands imposed by the second World War could not be met without the support of the universities. The additional funding resulting from war related research provided further impetus to commercializing and generating revenues out of university inspired inventions. The government, in turn, played its part in increasingly sponsoring research by the universities. A major issue in this regard was whether the government should

secure the commercial rights to patentable inventions for themselves or leave it to the patentees<sup>4</sup>.

In 1941, the Office of Scientific Research and Development was established to coordinate weapons research and to advise on scientific research and development. Dr Vannevar Bush served as the chairman. An important contribution of the office was the very successful two billion dollar Manhattan Project. After Dr Bush became President Roosevelt's Science Advisor, he was asked to come up with proposals for applying the lessons learned during wartime to civilian use. Having witnessed the benefits of university research to the Manhattan Project, Dr Bush recommended using university research in civilian applications. To achieve this goal, Dr Bush argued for an increase in support by the federal government for scientific research at universities<sup>5,6</sup>.

At the same time, universities were becoming more sophisticated in their technology transfer programme, even in areas where there was a lack of government-sponsored research. After the war, universities started concentrating more on fundamental and long-term research issues. In 1950, Congress established the National Science Foundation (NSF) to support basic scientific research at universities. It was becoming clear that transferring inventions created in the universities to the private sector for commercial use was essential to future economic growth and global business competitiveness. While the NSF was aimed at providing grants to research organizations, the Federal Government started allocating resources to find cures for diseases and eventually created the National Institute of Health (NIH)<sup>7</sup>. However, because of the Cold War, which reached its peak in the 1960's, the Federal Government's dependence on university research in areas other than medical research increased. In the 1960's, the need for a government-wide policy on inventions and patents was beginning to be felt. President Kennedy's scientific advisor, Dr Weisner, proposed establishing government-wide objectives and criteria for allocating legal rights to inventions between the government, which funded the research, and the contractors, who actually performed the research.

As another example of the trend for 'technology transfer', Stanford University in California started granting extended leases of the university's land to high tech companies. Long before the start of recent Silicon Valley revolution and the 'New Economy,' the Stanford Industrial Park was founded to create a

centre of high technology close to a cooperative university<sup>8</sup>. Today, it is estimated that eleven new companies are being created every week in Silicon Valley, which is nearby to Stanford University<sup>9</sup>.

By the 1970's, the United States was experiencing a shift towards a more service-oriented economy. The erstwhile manufacturing states like Illinois, Michigan, Ohio, and Pennsylvania were suffering economically. Major recessions led to manufacturing industries being closed, unemployment, emigration from the affected states, and an overall decline in prosperity. To counter this trend, several states tried opening business incubators to foster economic development through job growth. These incubators lead to some revitalization. Even with this revitalization, there were fewer than ten incubators open in the US by 1980. The passage of the Bayh-Dole Act of 1980 changed the landscape completely.

### **The Bayh-Dole Act**

The Bayh-Dole Act provided impetus to university licensing offices to use start-up companies to commercialize early stage inventions<sup>10</sup>. Hundreds of start-up companies have resulted from this impetus. The Bayh-Dole Act was passed to address concerns about declining US productivity. The rising competition from Japan alarmed legislators. Further, they were receiving complaints regarding the government's inconsistent treatment of contracted inventions. The Act was a combination of many policy goals and sought to establish a uniform patent policy within the government. The Act essentially changed the presumption of title to any invention made using government funds from the government to the contractor or patentee that actually created the invention<sup>11</sup>.

Whenever there is a contract, grant, or cooperative agreement between any federal agency and any contractor for the performance of experimental, developmental, or research work, provisions of the funding agreement under the Bayh-Dole Act are implicated. The project could be funded fully or only in part by the federal government. The inventors associated with the project are required to promptly disclose their inventions. If the institution where the inventors perform the research fails to notify the government within two months of disclosure, according to the Bayh-Dole Act, the title could pass on to the government. If the university does not retain title within two years, then title vests with the

government. Inventors may also petition the funding agency to obtain title to the invention. The titleholder must file for a patent within one year of electing title.

In certain areas that are government-dominated like aerospace and defense, the government retains rights to the invention. According to the Bayh-Dole Act, the titleholder can license, but not assign, rights to others. Also, licensees are required to exploit the technology and produce the goods and services in the US. The royalties must be shared with the inventors.

The government receives a large number of proposals for grants that are themselves a significant source of scientific knowledge. This is because Bayh-Dole Act requires publication of these proposals. If the knowledge disclosed in these proposals is not protected as confidential, the corresponding publications can even be used as prior art against a patent applicant.

Congress passed a series of amendments to the Bayh-Dole Act in 1984, which extended its provisions to inventions originating at government-owned, contractor-operated facilities. It also repealed limitations on the permissible duration of licenses from nonprofit organizations to large businesses for government-sponsored inventions. In 1986, the Federal Technology Transfer Act was passed which authorized federal laboratories to enter into cooperative research and development agreements (CRADAs) with outside entities<sup>12</sup>. The laboratories were allowed to agree in advance to assign or license any patents on inventions made by federal employees in the course of collaborative research to the collaborating party.

It is clear that the 1980's signaled the start of a pro-patent trend in the United States. Subsequent legislation continued to broaden and fortify the pro-patent policy. It is virtually guaranteed today that regardless of whether federally-sponsored inventions are made directly by the government or by universities and private entities using government funding, anyone involved in the research project who wants the technology to be patented will prevail over the objections of anyone else who argues that the technology should be placed in the public domain. A sponsoring agency may insist on obtaining a patent even if a university is reluctant to patent an invention made in its laboratories with federal funds.

In cases where the government expresses its disinterest in pursuing a patent, the individual inventor(s) can file for patents on his or her own.

Such a policy has been justified as a means of improving productivity in American industry and ensuring that the results of taxpayer-supported research are translated into useful products and processes.

Transfer of patent ownership to the research partner outside the government that started with the passage of the Bayh-Dole Act, sparked a technology transfer boom in the early eighties. Research and academic institutions started technology transfer programs and generating licensing income and spin-off companies. Bayh-Dole continues to have broad implications in a large part due to the fact that federal funding is today still a significant source of revenue for US universities and research institutions. In 1996, the Association of University Technology Managers (AUTM) estimated that the licensing activities of academic institutions, nonprofit organizations, and patent management firms add more than 24.8 billion dollars and 212,500 jobs to the US national economy each year.

The Bayh-Dole Act fostered a new era in the relationship between the government and universities. The Act permits universities to establish and/or expand technology transfer capabilities. The number of academic institutions receiving patents increased from 75 in the 1980's to 175 by 1997. Such a trend in patenting by universities simply reflects the importance of academic research to economic activity. While obtaining patents is a measure of tech transfer, the real measure is the amount of patented technology that has been transferred to the private sector for further development into commercially viable products and processes that society finds useful. In this regard, patent licenses and other transfers of technology have increased steadily since the passage of the Bayh-Dole Act.

### **IP Ownership by Universities**

Universities today generate a large number of ventures in collaboration with industry. Industry-sponsored research, business incubators, and spin-off companies provide revenue-generating opportunities to the universities. While these collaborations are undoubtedly fruitful, they can also be difficult. These difficulties are rooted in the guiding principles of the existence of these entities. Universities believe in sharing knowledge, whereas maintaining confidentiality is a key to running businesses. Universities have the public goal of educating the

masses, whereas corporations and other private ventures exist to create profits. An effective technology transfer policy must manage these divergent interests. The institution's core values and principles must be considered in determining how best to manifest them in its IP management policies and practices.

Two key ways to transfer technology are the use of license agreements and the establishment of new ventures.

License agreements can be used to exploit intellectual property (IP), such as patents. Patents are a critical component of any IP management policy because they provide the holder a property right in return for public disclosure of the invention. They can also be used as a metric to evaluate innovation at the institution. Being deeds of property rights, they come with special legal considerations and requirements. Patents form the core of any related license that in turn generates revenue.

Universities can also help establish new ventures as they foster the spirit of entrepreneurship at any institution. They motivate faculty and student entrepreneurs and, while requiring investment, create wealth for the stakeholders. Because of this, they have the potential to create various conflicts of interest.

Both patents and new ventures are assets that result from innovations created within the university with the involvement of faculty and students. Therefore, the issues of ownership and control of these assets become critical. Several important issues need to be considered to successfully and strategically manage patents and new ventures. It should be decided early on who the owners of the patents will be and who will make licensing decisions and on what terms. Since the cost of obtaining patents is great, it must be decided who will fund the process of patenting and licensing. Likewise, in the event of a potential windfall, a revenue sharing plan must be put in place from the beginning. For new ventures, it must be decided what level of involvement the institution will have and what financial and management stake the institution will hold.

Issues of ownership and control must also be decided. A common model is that the institute owns any IP created by faculty and students. In such cases, an employment agreement clarifies the ownership. The employee is required to promptly disclose inventions or improvements assist in the patenting process, and execute all required documents for patent

prosecution. Universities often use this model for their own faculty/student inventors. Universities using this model should include all the relevant requirements in the faculty employment agreement. In addition, the employment agreement should also include terms for termination, compensation, etc.

If the university does not use employment agreements, common law will determine ownership of inventions. In general, ownership follows inventorship. It is also established that the rights of ownership belong to the employer only if the employee was hired to invent, and that the employer has the burden of proving the employee was hired to create the particular invention that is the subject of a dispute.

### **Case Study: Massachusetts Institute of Technology**

The Massachusetts Institute of Technology (MIT) is known around the world as a leader in the development of technology. Does MIT's means of technology transfer live up to its formidable reputation as a leading academic institution? In some ways, the answer is yes. The final judgment on MIT's particular implementation of a technology transfer programme will be left to the reader. At the very least, peeking into a concrete implementation at a key American institution will provoke at least some retrospection as to the applicability of the ideas in other settings<sup>13</sup>.

The programme at MIT is implemented in large measure by the MIT Technology Licensing Office (TLO), which has two principal goals. The first is to facilitate the transfer to public use and benefit of the technology developed at MIT. The second goal, subordinate at least in theory to the first, is to provide an additional source of unrestricted income to support research and education at MIT. The TLO is not an end in itself, but aspires to work towards its goals without interfering with the normal routine of preparation and publication of technical and academic information.

The TLO has the responsibility to recommend and disseminate the policies that implement the technology transfer programme. The policies are naturally those of the university, not those of the TLO, which is just an office in the university infrastructure charged with such responsibilities.

At a university as large and diverse in focus as MIT, it is not surprising that 'technology' can mean anything and everything, and technology transfer is not limited to obtaining patents or to minding

copyrights. In many instances, the distribution and commercialization of technology is accomplished by the transfer or licensing of the intellectual property rights, such as patents and copyrights, but this is not the end of the story. The distribution and commercialization of technology also depends, at times, on access to the embodiment of the technology: biological organisms, plant varieties or computer software. In view of this, the policies of the TLO need to cover not only the ownership, distribution, and commercialization rights associated with the technology in the form of intellectual property, but also the use and distribution of the technology in its tangible form.

The TLO provides information about patents. This information is not only the general description of patents and rights, and the procedures for obtaining them in the United States, but also some important insights and cautions regarding safeguarding and obtaining patent rights outside the United States. Similarly, the TLO policy statements provide descriptive and procedural information concerning, *inter alia*, copyrights, trademarks, service marks, trade secrets, mask works, and research materials such as those mentioned above.

With regard to trade secrets, it should be noted that the university is not itself normally engaged in the protection of their own trade secrets, but it is recognized that research at the university may involve cooperating with outside institutions, and that the duties and responsibilities for protecting trade secret information must be understood by the people from MIT that are involved. Since trade secrets are ideally not included in a technology transfer programme from the standpoint of making such secrets available to the public, trade secrets of cooperating institutions should be one of the things that a good technology transfer program takes into account in the best way possible.

At MIT, as in other institutions, there is recognition of the tension inherent in a technology transfer programme that has, as one of its goals, the accumulation of funds for the good of the university. This inherent tension comes about from the goal of free, frank, and fast information transfer among scholars, in equipoise with the goal of the protection of ownership and development rights. In such a built-in conflict, there can be only one head of the household, only one of these goals that reigns supreme. At MIT, the balance is intentionally tipped

towards the side of forwarding education and research instead of the side of profit and ownership.

As to ownership, however, MIT makes it clear where the university stands. The university policy is that patents, copyrights on software, mask works, tangible research property, and trademarks developed by faculty, students, staff and others, including visitors participating in MIT programmes or using MIT funds or facilities, are owned by MIT when the intellectual property was developed in the course of, or pursuant to, a sponsored research agreement with MIT; or the intellectual property was developed with significant use of funds or facilities administered by MIT. Also, MIT states that it owns all copyrights, including copyrighted software, when it is created as a 'work of hire' under the US copyright laws; or when it is created pursuant to a written agreement with MIT providing for transfer of copyright or ownership to MIT.

The MIT policy also sets out when an invention or other IP is owned by the inventor or author. This is an important aspect of a good technology transfer programme. In other words, it is just as important to define when the institution owns something as it is to set forth when the institution does not own something. At MIT, the inventor or author owns the rights whenever MIT does not own them. Of course, research contracts sponsored by the Federal Government are subject to the statutes and regulations already mentioned above.

Earlier, it was mentioned that MIT owns the IP when the IP was developed with significant use of funds or facilities administered by MIT. Drilling deeper for more insight, however, reveals that there could be significant disagreement as to what constitutes a significant enough use of funds or facilities to convey ownership to MIT. Accordingly, the technology transfer programme at MIT goes to some length to set forth points that can be used as navigational beacons to safely chart one's course through what might be otherwise murky waters.

Generally, an invention, software, or other copyrightable material, mask work, or tangible research property will not be considered to have been developed using MIT funds or facilities if the following four conditions are all true: (1) only a minimal amount of unrestricted funds have been used; and (2) the invention, software, or other copyrightable material, mask work, or tangible research property has been developed outside of the assigned area of

research of the inventor/author under a research assistantship or sponsored project; and (3) only a minimal amount of time has been spent using significant MIT facilities or only insignificant facilities and equipment have been utilized; and (4) the development has been made on the personal, unpaid time of the inventor/author. For the sake of even greater clarity, MIT agrees that the use of office, library, machine shop facilities, and of traditional desktop personal computers are examples of facilities and equipment that are not considered significant.

When IP has been developed using significant MIT funds or facilities but is not the subject of a research agreement, the policy for technology transfer at the university provides that the TLO may license the inventors exclusively or nonexclusively on a royalty basis. This licensing does not happen in every case, but is likely to occur where the inventors demonstrate technical and financial capability to commercialize the IP. Commercialization should be achieved within a period of a few years, or the inventors are deemed to have waived their rights to the royalties and the TLO will terminate their license.

As one might expect, the university clearly disclaims any right to an interest in the ownership of books, articles and other scholarly publications, or to popular novels, poems, musical compositions, or other works of artistic imagination which are created by the personal effort of faculty, staff and students outside of their assigned area of research and which do not make significant use of MIT administered resources.

MIT does give its faculty an incentive to seek and obtain patents, on two levels. A list of patents awarded appears on the faculty personnel record, although this may not be as prestigious as publications in peer-reviewed journals when it comes to tenure/promotion. Financially, there is revenue sharing on licensing fees as mentioned before. A percentage goes to MIT; a percentage may also be paid to the inventor's group (lab or department) and a percentage to the inventor. In addition, the faculty gets to own and exploit the patent if the institution determines that it has no such interest. The faculty member files an invention disclosure with the TLO, which reviews it. If the TLO decides that MIT is not interested, they may even assign the rights to the inventor to do with them as he wishes. The inventor then has full control of the IP. Interestingly, MIT as a matter of routine policy will not seek protection for

inventions, which are not commercially attractive, even if the invention is intellectually meritorious.

Having glimpsed into a few of the many aspects of the MIT technology transfer program, it is easy to see the high level of importance this institution places on technology transfer. The ownership of IP certainly appears on the balance to favour a presumption that the university owns more than it does not own. Nevertheless, the policy provides incentives, both professional and monetary, to encourage innovation and technology transfer.

### Conclusion

India has spent significant amounts of public resources from the beginning of its independence and, in some cases, even before, in establishing world class research institutions and supporting them with ample resources. It is critical that the technology developed by these institutions is commercialized and that the direct benefits are returned to the government and/or to society. An effective technology transfer policy will go a long way in achieving that objective. The United States has a long history in supporting technology research and utilizing the results commercially. India should draw on the experience

and history of technology transfer in the United States to help it establish its own effective technology transfer policy.

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